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SECOND REPORT

OF THE

VICTORIA CAVE EXPLORATION

COMMITTEE.



BY R. H. TIDDEMAN, M.A., F.G.S.



ABSTRACT OF THE THIRD REPORT OF THE SETTLE CAVES (VICTORIA CAVE) COMMITTEE, read at BRISTOL, in August, 1875, by R. H. TIDDEMAN.

Work has been carried on almost uninterruptedly throughout the year, (except from March the 20th to May 20th, when it was stopped for want of funds), at a cost of £175 12s. 7d. Of this £80 11s. 9d. was a balance in hand, £50 the British Association Grant, and £45 0s. 10d. raised by private subscription.

Great progress has been made in the past year in uncovering the glacial deposits at the entrance of the cave, and showing their relation to the older bone-beds containing the remains of man with the extinct animals. The boulders are seen to cover an area of at least 1200 square feet. They are of all sizes, and consist of dark and white Limestone, and the basement bed of that formation, Carboniferous Gritstone, and Silurian Grit. Some have travelled at least two miles and others greater distances. They are various in size from mere sand grains to blocks several tons in weight. An interesting section was displayed, showing the passage of the boulder-beds in one part from a regular till with large scratched stones, through scratched gravel, sand, to laminated clay, and these were so interbedded as to demonstrate that some at least of the laminated clay is of glacial age and origin.

At length after six years' work, we are able to say that we have reached the floor of the cave at the entrance. Several pinnacles of rock have been found by the removal of the boulders; they run in lines parallel with the joints of the rock above, and give testimony to the cave having been at some time occupied by a stream, similar rock-weathering occurring in other water caves in Craven. The arched niches on the right of the cave at the entrance lead to the same conclusion.

And now with the additional evidence of another year's diggings, we may again consider the question, the most interesting perhaps of all the problems before us;—Are the Glacial deposits which rest upon the older bone-beds, containing the extinct mammals and man, in the position which they occupied at the close of the glacial conditions, or have they subsequently fallen into their present site? We may again urge the reasons given last year (see Second Report), strengthened by enlarged sections and a wider experience, which go to prove the first alternative. To these arguments we may now add the following: That the extent of the glacial deposits now exposed, is so great that it is impossible that they can be a mere chance accumulation of boulders which have been re-deposited in their present position since glacial times. This being the case, it is clear from the position of the boulders beneath all the screes, that they are a portion of the general glacial covering of the valleys and hill sides which was left by the Ice-sheet at the time of its disappearance.

These are the main arguments to be derived from the Cave itself, but further strong presumptive evidence, that the Pleistocene fauna lived in the North of England before the Ice-sheet, exists as follows:—The older fauna once lived in this district, a point which admits of no dispute from its existence in the Victoria Cave, in Kirkdale Cave, Raygill Cave in Lothersdale, and

perhaps in other Caves. But their bones are now found nowhere in the open country. None of the river-gravels contain them; and just that district which is conspicuous by their absence, is also remarkable for the strongest evidences of great glaciation. Putting these facts together, the probability is very strong that it was glaciation that destroyed their remains in the open country. To suppose that these have been destroyed by other sub-aerial agencies, would be to ignore the fact that in the South of England and other non-glaciated areas, such remains exist both in the caves and river-gravels.

A few bones were found lying upon the boulders beneath the talus. They have been determined where possible by Professor Busk, but they are only fragmentary and not of much interest; they were probably washed out of the Lower Cave-earth when it was exposed above the edge of the boulders. No fragments of bone were found throughout the 19 feet of talus which lies between the base of the Neolithic layer and the top of the boulders.

Work in Chamber D.--A considerable amount of work has been done in excavating this chamber which leads off from the principal entrance towards the right. It was choked to the roof over the greater part of its extent, with clay and limestone blocks. It is now 110 feet long, 20 feet wide, and 20 feet high at the entrance. Two galleries lead off from it on the right. One, the Birkbeck Gallery, is made easily accessible for a distance of 44 feet, in a N.E. direction. Here it becomes very narrow and leads to a narrow chasm 20 feet deep. The other gallery is blocked at the entrance with stalagmite.

A magnificent series of bones was found in Chamber D. They were all carefully registered as to their position by Mr. Jackson. The Committee are much indebted to Professor Busk, for his kindness in determining them. He says, "They are a remarkably interesting collection, especially in the Bears, and I think the larger of the two skulls is by far the finest specimen of the kind yet found in this country."

"Out of about 269 specimens including detached teeth

127	belonged to	Bear
37	" "	Hyæna
36	" "	Bos
24	" "	Fox
22	" "	Deer { 15 Red Deer 7 Reindeer
10	" "	Rhinoceros
2	" "	Horse
1	" "	"Badger."

To these we may add 1 of Pig, 2 of Elephant, and 1 of Hippopotamus. The Rhinoceros is *hemitechus*, the Elephant *antiquus*, and the Hippopotamus, a portion of a tusk, is the only specimen of that animal found in the course of six years digging. The careful registration of the remains has enabled your reporter to construct a section showing the distribution of the different

animals throughout the different portions of the deposit. It is too bulky for publication, but the result may be given in words. The bones group themselves along two horizons separated by a greater or less thickness of laminated clay, cave-earth, and stalagmite. The lower extends from the back of the boulder-beds at the cave mouth, is continuous with that which contained the human *fibula*, and runs continuously as far as Parallel 42. The upper bed commences only at Parallel 15, close against the roof, and continues to P. 43. Where the upper bed commences the two horizons are about 12 feet apart, but they gradually approach each other, and at P. 35 not only touch, but seem to be somewhat commingled.

From this section we find that the following species are—

Peculiar to the Upper Bed.	Peculiar to the Lower Bed.	Common to both.
Badger.	Hyæna.	Man.
Horse.	Brown Bear ?	Fox.
Pig.	<i>Elephas Antiquus.</i>	Grisly Bear.
Reindeer.	<i>Rhinoceros hemitechus.</i>	Red Deer.
Goat or Sheep.	Hippopotamus.	
	<i>Bos Primigenius.</i>	

Brown Bear has previously been found in the upper beds in other parts of the cave. The upper bed probably contains remains from the Reindeer period to the present, those of later date being mixed up with older in the mud at the surface. But as distinguished from the lower bed the chief characteristics of the upper appear to be the presence of the Reindeer, and the absence of Elephant, Rhinoceros, Hippopotamus, and Hyæna.

In the upper bed the only sign of man's presence consists of the spinous process of a vertebra of a bear, which has been hacked apparently by some cutting instrument with a tolerably regular edge. It might have been done with a bronze celt or polished flint axe. It is probable that Chamber D was never the resort of man within the historic period. The soft wet mud of the floor, and the lowness of the roof, render it most unlikely that any one would take to it, except under the direst necessity, or in the pursuit of science.

In the lower bed again evidence of man's presence is but scanty. At the mouth, and close to where the human fibula was found, we have this year met with a piece of rib apparently nicked by human agency. The nicks appear to have been made by some clumsy instrument drawn backwards and forwards. They are in character totally unlike the square-troughed gnawings of rodents, and the furrows heavily ploughed by the teeth of carnivores.

And now, having restricted ourselves to the hard road of fact, we may, perhaps, in conclusion, be permitted to indulge in a short flight of fancy. Let us endeavour to realise how great is

the distance in time which separates the savage of Craven from our own day. We have the history of much of it in the Victoria Cave itself, and we may restore some of the missing pages from the surrounding district.

At the cave, Roman times are separated from our own by sometimes less than one, but not more than two, feet of talus, the chips which time detaches from the cliffs above. The Neolithic age, which antiquaries know was a considerable time before the Roman occupation, is represented by a layer in some places four or five feet beneath the Roman, in others even running into it. Then comes a thickness of 19 feet of talus without a record of any living thing. Judging by the shallowness of the Roman layer this must represent an enormous interval of time. And this takes us down to the boulders, the inscribed records of the Glacial Period. They must represent a long series of climatal changes, during which the ice was waxing and waning, advancing and melting back over the mouth of the Victoria Cave. This period saw the Reindeer and the Grisly Bear occasionally in possession. Then we have an unconformity, a break in the continuity of the deposits, the boulders lying on the edges of the older beds. Time again! and that time long enough for changes to take place which allowed the district to cool down from a warmth suitable to the Hippopotamus, and become a fitting pasture ground for the Reindeer. It was in that warm period that the early Craven savage lived and died.

But these are not all the changes which occurred in the North of England since that time. The age of the great submergence represented by the sea beaches of Meel Tryfaen, and Macclesfield, and by the Middle-Sands-and-Gravels of Lancashire, has left no record up at the cave. Your reporter is of opinion that the submergence did not attain in that district a greater depth than six or seven hundred feet, and this would still leave the cave 750 feet above the sea, though it would cut up the land into a group of islands. The fact is sufficient for us, the depth is immaterial.

Upon no fact are geologists better agreed than upon the existence of a wide-spread submergence and emergence of land towards the close of the Glacial Period. No tradition is common to more races and religions than that of a great deluge. Where back in the past is the common point whence these two far-travelled, almost parallel rays of truth had their origin? In the opinion of your reporter the Craven savage who lived before the Great Ice-sheet, and before the Great Submergence, may form another of the many strong ties which bind together the sciences of Geology and Anthropology.

P.S.—Persons desirous of assisting in this interesting investigation, may forward their Subscriptions or Donations to the Hon. Treasurer, John Birkbeck, Jun., Esq., The Craven Bank, Settle, Yorkshire.

[Reprinted from the REPORT of the BRITISH ASSOCIATION for the
ADVANCEMENT of SCIENCE for 1874.]

SECOND REPORT OF THE COMMITTEE, consisting of Sir JOHN LUBBOCK, Bart., Prof. HUGHES, Prof. W. BOYD DAWKINS, MESSRS. L. C. MIALI and R. H. TIDDEMAN, appointed for the purpose of assisting in the Exploration of the Settle Caves (Victoria Cave). Drawn up by R. H. TIDDEMAN, Secretary.

The Committee have to record their deep sorrow at the loss sustained by the death of one of their number, the late Professor Phillips, a loss so universally felt, that any remarks upon the matter would be superfluous; suffice it to say that Professor Phillips took great interest in the exploration, and was very anxious for its further prosecution.

On the 18th September, the Committee, with a select party of the Members, went to see the Cave and the Cave Collection, at the invitation of Mr. John Birkbeck, Sen., and were most hospitably entertained by him and his son, the Treasurer and Secretary to the Settle Committee. Although the weather was very bad and dusk came on earlier than was convenient, enough was seen to show the members of the expedition the chief bearings and difficulties of the exploration. On their return, the Museum at Giggleswick School was visited, and much satisfaction was expressed at the results already obtained, Professor Phillips in particular being very warm in his admiration.

At a Meeting of the Settle Committee held at Giggleswick on the 9th of October, Sir J. P. Kay-Shuttleworth, Bart., in the chair, the further working of the Cave was discussed, and it was decided that work should be recommenced so soon as subscriptions to the amount of £100, inclusive of the Association grant, had been received. It was further proposed and agreed that your Reporter should be entrusted with the scientific direction of the work. There being a debt of over £37 from the work of the preceding year, Mr. John Birkbeck, Sen., one of the most energetic promoters of the work from the commencement, generously paid that sum in order that the Committee might start afresh unhampered by any liabilities.

The Settle Committee have raised and expended in the course of the year, besides the British Association grant of £50, £113 4s. 3d.

On the 7th October a most important communication was received from Professor Busk. It was to the effect that a certain bone from the cave, which had been in his keeping some time, and had been doubtfully referred to elephant, was undoubtedly human—a fibula of unusually clumsy build, and in that respect not unlike the same bone in the Mentone skeleton. This bone was exhumed by the Committee in May 1872, and was lying in juxtaposition with, and under circumstances

which left no doubt of its having been contemporary with, *Ursus spelæus* and *ferox*, *Hyæna*, *Rhinoceros*, *tichorhinus*, Bison, and *Cervus elaphus*; also close by it were two small molars of *Elephas*. It was at first supposed that these were *primigenius*. Dr. Leith Adams, however, during the past year expressed a doubt upon the determination, and after a careful comparison with type specimens in the British Museum, pronounced them to be *Elephas antiquus*, an opinion in which Mr. T. Davies concurs. Professor Busk after examining them again does not commit himself to a definite opinion, but thinks on the whole that they are most like *antiquus*. The balance of opinion, therefore, strongly preponderates in favour of Dr. Leith Adams's decision, and this is important as extending the range of that species. It had been before found at Kirkdale, but was previously unknown in the north-west of England.

On the 9th of December Professor Busk read a paper upon the human fibula to the Anthropological Institute. He states that "there is nothing in the condition of the bone opposed to its belonging to the most remote antiquity, nor to its owner having been coeval with the extinct mammalia (before mentioned), with whose remains the specimen, as to condition, differs in no appreciable respect. Its interest, therefore, as representing one of the earliest extant specimens of humanity, will be at once obvious. But in another regard also it appears desirable that some notice of it should be placed on record. The very unusual form and thickness of the bone have caused such great difficulty in its recognition as human, that it is well worth while to draw attention to its peculiarities." Professor Busk proceeds to state that after much hesitation he was induced to think, at the suggestion of Mr. James Flower, that the bone in question might be referred to a small form of elephant; but considerable doubt remained on their minds until Professor Busk saw the Mentone skeleton at Paris, and noticing the thick and clumsy fibula belonging to it, was at once struck with the apparent resemblance between it and the Victoria-Cave bone. Following up this suggestion, Mr. James Flower discovered in the Museum of the College of Surgeons a recent human fibula of unusual thickness, which at once removed all doubt. The circumference of the cave bone about the middle is 2".2. The unusually thick fibula with which Professor Busk compares it measures 2", whereas he considers that ordinary full-sized human fibulas may be taken at from 1".4 to 1".8. It is obvious, therefore, that the Settle specimen is unusually thick. Professor Busk expresses his opinion that it does not appear from the form of the bone that the corresponding tibia was platymeric, but he hopes that further exploration may clear up this and other interesting points. (Journal of the Anthropological Institute, vol. iii. No. 3, pp. 392-4.)

This communication was of the greatest interest; for it had been some time before pointed out that there was much chance of the beds in which this bone occurred being preglacial, or at any rate of an age preceding that time when Scotland, a great part of Ireland, and the north of England were slumbering beneath a great sheet of ice similar to those which now cover the greater part of Greenland and enshroud a portion of the southern hemisphere.

The Committee was decided by this in its course of work for the year. The question was one of such importance, that we felt the first thing to

be done was to develop all the evidence that could be procured upon the question of whether these beds containing the older mammals and Man were of preglacial or interglacial age or not.

In order that these operations may be the better understood, it is necessary briefly to recapitulate the order and succession of beds inside and outside the cave. The three principal beds inside the cave are

The Upper Cave-earth,
The Laminated Clay,
The Lower Cave-earth.

These beds were described by your Reporter in a communication to the Settle-Caves Committee early in 1871, and subsequently to the British Association in 1872, but appeared in full in the 'Geological Magazine' for January, 1873, to which he must refer for detailed description. In those communications reasons were given for thinking it probable that the laminated clay was accumulated under glacial conditions from the muddy water of a glacier or an ice-sheet. Such water would penetrate hollows in the rocks anywhere, and have a tendency to throw down its mud. Subsequent explorations have only served to confirm this view. First (in 1872) came the discovery of the Pleistocene fauna at some depth below the laminated clay, they never having been found above it. Next, the exploration brought to light the existence of a bed of glacier boulders resting on the denuded edges of the lower cave-earth. The work of the past year has shown exceedingly well the extent and importance of this bed, and further has brought to light the existence of several well-glaciated small boulders in the laminated clay itself. This clay, so far, has yielded no organic remains. It ranges quite across the cave, and is co-extensive with the explorations so far as they have gone, and in one place attains a thickness of 12 feet. It has been a horizon of great importance from its continuity, distinguishing the earlier from the later beds. The latest work in chamber D (on the right), however, appears to show that it is diminishing in thickness as we go inwards in that direction. Besides the main bed of it, many of the little chinks between fragments of rock in the lower cave-earth have been filled up with it. This filling in may have occurred at about the same time as the formation of the great mass above; for certainly glacial conditions imply amongst other things the running of much muddy water, and wherever preexisting chinks occurred, they would have much chance of being filled up. Laminated clay of course may be, and often is, formed under other than glacial conditions (that of the Victoria Cave, indeed, bears a strong resemblance to the famous Nile-mud); but here its thickness and the contrast it affords to the deposits above and below, taken with its extent, seem to demonstrate a change and a long continuance of distinct physical conditions.

It was noticed by those who visited the Victoria Cave last year that it is approached by a narrow cutting on the right as you face it. This had been made through a great thickness of "scree" or limestone talus; and below that talus, close to a large fallen block of limestone, which, with the face of rock on the right, formed a natural arch about 7 feet high, were visible at that time a few glaciated boulders. It was determined to expose these boulders and follow them, noting their position and range

but, in order to do this, we were under the necessity of removing a great mass of talus. Moreover, the "tip" of the old workings had accumulated in the front to such an extent as to seriously impede the operations. We therefore proceeded to remove a large breadth both of the tip and of the talus. The removal of the tip was of course mere mechanical labour, but the talus was removed with careful searching for the following reasons.

In the first place, it occurred to us that if the boulders beneath the cliff had fallen from that cliff, or from hollows in it, it was not improbable that other boulders might be found at different heights in the talus.

Secondly, we thought that if the boulders at the bottom of the talus had been deposited in their position in glacial times, and the talus represented the wearing away of the cliff by frost and other atmospheric influences, we might get a succession (an imperfect one, but still a succession) of different forms of life which had followed one another through that long period.

Our first inquiry established the fact that through this great thickness (19 feet) of talus, from the base of the Roman layer which lies within the first two feet of the surface down to the horizon where the boulders lie in a great mass, not a single fragment of foreign rock, whether of Silurian grit, of Mill-stone grit, or of limestone, other than that of which the cliff above is composed, occurred. The whole mass consisted of sharply angular fragments of white limestone. No rounded forms existed; nothing with any of the characteristics of ice-worn boulders or of stream-borne pebbles. The whole deposit spoke of the slow wearing away of a cliff, free from drift, by the ordinary effects of winter frosts and summer rain. The edge of the cliff, on the retiring of the ice-sheet, was probably as free from glacial drift as we now find it.

Our second inquiry, which proceeded simultaneously with the first, met with only negative results. From the bottom of the Roman layer to the main mass of boulders we met with no bones whatever, nor with any evidence of man's presence.* If, through the long time represented by these 19 feet of talus, animals existed in the neighbourhood, either they did not happen to die at or to be carried to the spot excavated, or their bones have been entirely dissolved by the action of rain. The former seems the more probable alternative; for if bones were dissolved, some remains of teeth at any rate would probably survive. A few bones, however, were found upon and among the boulders; these we have not yet had an opportunity to determine, and from their position it is doubtful to what age they may belong, for it is quite possible that they may have been washed out of the sloping denuded edges of the lower cave-earth on which the boulders rest. One appears to be a fragment of a very large bone, and possibly may be elephant; another is the os calcis of an ox.

The Roman layer, as the black band is with much reason called, contained several different kinds of pottery, some coarse and black, others white, and some red Samian ware. Of bronze articles six were found; two were bracelets, one consisting of three strands of wire twisted, with the hook by which it was fastened still remaining at one end; a second

* The Neolithic layer appears to have died out down the slope, or to have coalesced with the Roman layer.

was thicker, consisting of five strands, but merely a fragment, only one fourth of what must have been its entire length; a band of thin bronze plate, which looks as if it might have bound a sword or dagger-sheath; the bow end of a broken key; a scent-box or vinaigrette perforated with four holes, in appearance something like the top of a pepper-caster, only one side of it remaining, together with the hinge still in working order, and the loop by which it was suspended round the fair neck of its wearer. Similar ornaments are figured in 'Roman Antiquities, Mansion House,' by Mr. J. E. Price, F.S.A., to whom we are indebted for its identification. A sixth object was found amongst some of the Roman layer which had been thrown over the tip, and is of doubtful age.* It is a circular plate $1\frac{1}{2}$ inch in diameter, with a hole in the centre and two rivets at the back. It must have been affixed to some perishable material, for the rivets which project for some distance at their distal ends are quite perfect. It seems to have some traces of silvering at its centre. During the removal of the talus, the Reporter found three rudely discoidal pieces of Carboniferous gritstone, which appeared to have been roughly chipped to a diameter of between 5 and 6 inches. They were red, and had evidently been subjected to fire; most probably they had been used as pot-boilers, and their discoidal form was given to them that they might better fit the bottom of the pot. They were from the upper portion of the talus, that containing the pottery, but the exact position had been forgotten by the workmen.

As the summer advanced, the talus and overlying "tip" were so far removed that it was determined to convene a Meeting of the Committee and others to witness the removal of the layers of talus and the uncovering of the boulder-bed. Invitations for the 6th of July were issued to all the Committee, to all who had written papers on the cave, and some other geologists.

Of the British Association Committee, only Mr. Miall and I were able to attend; Mr. John Birkbeck, jun., represented the Settle Committee; we had the valuable assistance of Messrs. Aveline, Dakyns, and other gentlemen. We were unfortunately deprived at the last moment of the valuable services of Professor Ramsay, who had expressed his intention of being present, but was prevented by public business.

In the course of the 6th and 7th of July the boulders were quickly brought to view and in great numbers; we counted over two hundred, of dimensions from a few inches to 6 feet in diameter, besides numberless smaller ones which it was not possible to preserve. Wherever a boulder was exposed it was left *in situ*, and the clearing away of the talus proceeded along the face of the bed. In several places we found a little clay above the boulders; but it was apparently of very recent introduction, and had been washed into the talus by the draining of water from above before the workings had got down to their present level. This was apparent from its containing blades of grass and pieces of straw which had not rotted away.

The boulders were found to be lying in an irregular layer from 3 to 4 feet thick at the bottom, dipping outwards from the cave in a direction W. 40° S., and extending across its mouth at the level where

* Mr. Franks has since assured me that there is no doubt of its Roman character.—R.H.T.

we were then working; but at the north-western extremity of its range it curved round more to the north, and therefore dipped more westerly, showing in all a breadth of glacial deposits of about 12 yards. The boulders consisted almost exclusively of blocks of Silurian grit and of Carboniferous Limestone in about equal numbers, but there were one or two of Carboniferous Sandstone. The form was quite enough to distinguish the Carboniferous Limestone boulders from the sharply angular blocks of the talus; but, besides, many of them were of the black bituminous limestone, and not of the white limestone in which the cavern is excavated. They were nearly all of a well-marked glacial form, and most retained glacial markings. One round pebble of limestone was found near the base of the bed. The sites, dimensions, and arrangement of some of the principal were noted with reference to a level datum-line running N. 40° W. from a mark upon the wall of rock on the right, and after the section had been well cleared of talus the boulders were marked (S) for Silurian and (L) for limestone, and then photographed. Angular pieces of limestone, similar to those in the lower cave-earth and in the talus, were mixed up with boulders throughout, and the whole was filled in with mud, but much of it appeared to be rather recent. The boulder-bed thinned away upwards, and is apparently thickening rapidly towards the dip; doubtless it will be found much thicker at a lower level.

In accordance with a suggestion from Professor Prestwich, a hole was dug in front of the large fallen block which forms the arch already mentioned, and the boulder bed penetrated. A great many large and small boulders were dug out of this hole. Beneath was a bed of angular gravel filled in with clay a few inches thick. When washed, the small pieces of stone of which it was composed were found to be really small boulders, many of them scratched and bruised. Whilst wet it bore some resemblance to the gravel which covers little cones of ice low down upon a glacier near the moraine, and which offers such apparently good, but really bad foothold to unwary travellers.* Below this were a few inches of yellow clay, which Mr. Jackson, our Superintendent, says is similar to that which was found at the bottom of the 12 feet of laminated clay in the 25-foot shaft in Chamber B. This is an interesting point; for if the laminated clay and the boulder-bed are both of glacial age, it seems likely that this thin bed of yellow clay beneath them may have been forming simultaneously inside and outside the cave; and these two spots, we believe, are the only places where we have found distinctly yellow clay during the explorations. Some small fragments of bone were found beneath the yellow clay in ordinary cave-mud with angular limestone, to all appearance lower cave-earth, similar to that more fully exposed in the cave; but we came down upon some very large blocks of limestone, and did not think it advisable to enlarge the hole.

This is the only vertical hole which the Committee have dug this year, and it is shallow, not more than 4 feet deep. All our operations have been conducted by digging out in horizontal layers, to avoid any confusion which might arise from the falling in or mixing up of things of different ages in vertical shafts.

* Forbes, 'Theory of Glaciers,' p. 241.

Those who were present at the uncovering of the boulders were unanimously of opinion that they had not fallen from the cliff in post-glacial times, for the following reasons:—

1. The cliff immediately above the cave is free from any boulder deposits for a considerable distance.
2. The boulders lie at the base of all the talus, which must have been forming ever since glacial conditions declined, and no other falls of even isolated boulders have occurred throughout the whole thickness of screes.
3. The boulders are so close beneath the cliff, that if all the limestone which has fallen from it and is now lying on the boulders could be restored to the cliff, it would project so much further forward, that the fall of the boulders from the cliff to their present position would be impossible.

Professor Prestwich and Mr. Bristow, who were good enough to visit the cave earlier in the year, both give it as their opinion that the boulders had not fallen from the cliff, but were part of the ordinary drift deposit which covers the bottom of the valley and lines the hill-sides up to the bottom of the cliffs hard by.

The important bearing of these questions upon the correlation and age of the drifts of England and the antiquity of Man cannot be over-estimated.* If rightly interpreted, it may give the key to much that has hitherto been unsatisfactory, and even contradictory, in Pleistocene geology.

In conclusion, the Committee have much pleasure in offering their thanks to the Settle Committee for the generous and liberal manner in which they have carried on this important investigation, and to Mr. John Birkbeck, Jun., for his valuable services as Honorary Treasurer and Secretary from the commencement.

They have also to thank the following gentlemen for assistance kindly given:—Professor Busk, Dr. Leith Adams, Mr. Franks, and Mr. T. Davies of the British Museum.

Your Committee propose that they be reappointed

* "The Relation of Man to the Ice sheet in the North of England," 'Nature,' vol. ix, No. 210, p. 14.



